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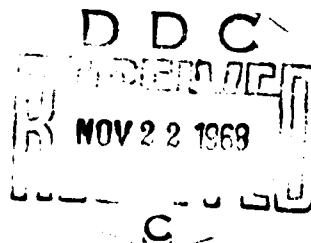
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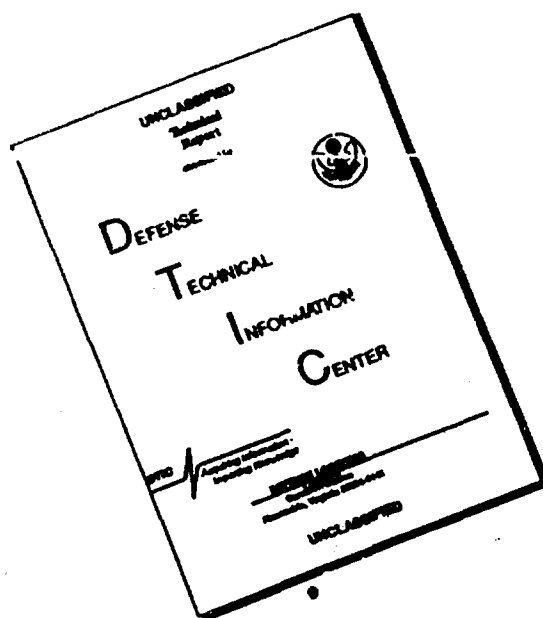


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**ANTITOXIN AND FREE TOXIN IN THE BLOOD IN STAPHYLOCOCCUS
INFECTION IN PATIENTS SUFFERING FROM TRAUMAS**

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Orthopedics and Traumatology), Vol 26, 1965, pp 67-69.

Staphylococcus infection is of great importance; it is apparently not always elicited in due time, especially in weakened patients suffering from severe injuries and closed purulent processes, in which the clinical and bacteriological criteria may prove inadequate. The elaboration of serological diagnostic methods of staphylococcus infection are therefore of extreme importance.

Of the numerous antibodies of the organism against the staphylococcus, alpha-antitoxin has been most thoroughly investigated; some authors attempted to use the determination of its titer for diagnostic purposes (Ye. I. Ivanova, Blair and Hallman, Lack and Towers et al.). However, the sum total of conducted observations does not allow us to consider this problem as sufficiently investigated.

There has been no investigation, or even posing, of the problem, whether the staphylococcus alpha-toxin circulates in the blood under proper conditions and whether it is possible to use its determination for diagnostic purposes. We have found a sole indication as to the probable circulation of the toxin in a recent report of V. G. Pikus concerning the chronicsepsis in patients suffering from neuropsychic disorders.

The task of this investigation is to determine the connection of various indicators of antitoxin level in the blood with the staphylococcus infection, and to try to develop its serological diagnostics based on the determination of the antitoxin and free toxin in the blood.

About 1000 blood studies have been conducted on 707 individuals on the antitoxin with the generally accepted hemolytic method. The results of these investigations are shown in the Table. Upon repeated investigations in the same patient, the highest titer was indicated in the Table.

Comparative Rate of Low, Medium and Higher Titer of the Blood Antitoxin in Various Groups of Healthy and Sick Subjects

Обследуемая группа 1)	Число обследованных 12)	Титр антитоксина в антитоксических единицах на 1 мл крови 13)		
		14) 1 AE	1-2 AU (3 AE и выше 15)	16)
		в процентах 16)		
Здоровые 2)	192	63,0	35,5	1,5
Из них: 3)				
носители патогенного стафилококка 4)	72	57,0	40,3	2,7
свободные от носительства 5)	77	74,0	26,0	—
Больные с закрытыми травмами и прочими процессами вне инфекции 6)	237	59,9	33,8	6,3
Больные с опухолями головного мозга вне инфекции 7)	43	86,0	14,0	—
Больные с опухолями прочих локализаций 8)	28	43,0	32,0	25,0
Больные с клинически выраженной, бактериологически доказанной стафилококковой инфекцией 9)	125	13,6	27,2	59,2
Больные в состоянии клинической компенсации инфекции при наличии патогенного стафилококка в ранах 10)	82	9,8	54,9	35,3
11) Всего	707			

Key: 1) Investigated group; 2) Healthy; 3) Of these; 4) Carriers of the pathogenic staphylococcus; 5) Free of carrying; 6) Patients with closed traumas and other processes without infection; 7) Patients with tumors of the brain without infection; 8) Patients with tumors of other localizations; 9) Patients with clinically manifested and bacteriologically proved staphylococcus infection; 10) Patients in the state of clinical compensation of the infection, with the presence of pathogenic staphylococcus in the wounds; 11) Total; 12) Number of examined; 13) Antitoxin titer in antitoxin units per 1 ml of blood; 14) Less than 1 AU (antitoxin unit); 15) 3 AU and higher; 16) In percentages.

In healthy subjects the antitoxin titers varied within limits rarely exceeding 2 AU per 1 ml. Patients with various traumas and other processes without infection had an antitoxic blood titer close to the titer of healthy individuals, however somewhat more frequently at 6.3%; titer were encountered of 3 AU per 1 ml, and higher. This can be explained by the known fact of the more frequent carrying of a pathogenic staphylococcus among patients who have been confined to a hospital for an extended period of time (Shooter et al., Williams et al., etc.).

Against this background, there stands out a group of patients with cerebral tumors who had somewhat lower antitoxin titers; the tumors of other localizations did not show this characteristic. If this difference is not accidental, it may be presumed that cerebral tumors, connected with neuroreflex disorders, exert a negative effect on immunity.

Patients with a clinically pronounced and bacteriologically proved infection (the pathogenic staphylococcus was in every case isolated from the focus) had in 59.2% a higher antitoxin titer -- 3 AU per 1 ml, and higher. In 40% of this group the blood antitoxin did exceed 4 AU per 1 ml, often comprising 6, 10, 12 AU per 1 ml, and in some cases -- 14, 16 AU per 1 ml.

These data are close to the data of Lack and Towers, who found in 122 orthopedic-traumatological patients with a diagnosed staphylococcus infection antitoxin titers about 2 AU in 78% of cases, and 4 AU in 48%.

In the last column of our Table we singled out the so-called compensated infection; they are patients with various wound processes taking place without any manifested local and general inflammatory reaction, but with the presence of pathogenic staphylococci in the wounds. Higher antitoxin titers were observed in this group in 35.3%.

Noteworthy are two groups of patients: patients with decubitus ulcers due to the trauma of the spinal cord, and patients with extensive burns. Despite the fact that upon inoculation of the wound-discharge these patients always revealed a predominance of *B. proteus* and *B. pyocyaneus*, while staphylococci were inoculated with difficulty and only in saline media, they nevertheless exert a strong toxic effect on the organism, since they lead to the development of antitoxic immunity. However, in the initial stages of these processes, during the severe general state of the organism, the antitoxin titers turned out to be low, despite the presence of infection. The blood serum in these patients showed reactions characteristic of the staphylococcus toxin. As the patients were recovering from their serious condition, the amount of antitoxin in the

blood increased. The development of granulations and wound epithelization coincided with the improvement of the patient's condition and a high antitoxin titer of the blood. Following complete healing of wounds, the antitoxin gradually decreased and approached its normal level.

The serum of 81 subjects -- 46 patients and 35 healthy (control) individuals -- was examined for the free toxin. The toxin was determined in an unheated serum, in accordance with the generally accepted hemolytic and dermonecrotic reactions to the toxin, with tests on the specific inhibition of these reactions by means of a standard antistaphylococcus serum.

Reactions to the toxin proved to be clearly positive in 12 patients with clinical and bacteriological proofs of staphylococcus infection. In 18 subjects, including ten healthy individuals, the serum hemolyzed rabbit's erythrocytes, without specific inhibition of hemolysis by means of the antitoxin, and induced no necrosis in a rabbit after an intracutaneous injection. We did not relate these reactions to the effect of the alpha-toxin; they apparently require further investigation.

In positive cases, the patient's serum, injected intracutaneously in the rabbit in the amount of 0.1--0.2 mg, induced within 24 hours a distinct necrosis which increased during the following 24 hours. The same serum hemolyzed rabbit's erythrocytes; the hemolysis, as well as necrosis, could be prevented by a preliminary addition of the antitoxic serum, whereas non-specific sera possessed no inhibiting action. All this speaks in favor of the fact that the staphylococcus toxin indeed circulates in the blood of some patients, and is responsible for their severe state.

CONCLUSIONS

1. Determination of alpha-antitoxin titer in the blood of patients may serve as an additional method for the diagnosis of staphylococcus infection. A higher, or increasing, titer attests to the presence of infection. The infection is not excluded in cases of low titers; in these cases it may prove useful to determine the free toxin in the blood.

2. The development of natural antitoxic immunity in patients suffering from burns, bedsores and other wounds indicates the pathogenic role of the staphylococcus, and determines the means of a timely immunotherapy of these patients.

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